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(71) Applicant: **FRAUNHOFER-GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN FORSCHUNG E.V.** [DE/DE]; Hansastraße 27c, 80686 München (DE).

(72) Inventors: **KASPARICK, Martin**; Kiefholzstr. 46a, 12435 Berlin (DE). **CAVALCANTE, Renato**; Otto-Suhr-Allee 65A, 10585 Berlin (DE). **STANCZAK, Slawomir**; Solinger Str. 8, 10555 Berlin (DE).

(74) Agent: **ZIMMERMANN, Tankred** et al.; Schoppe, Zimmermann, Stöckeler, Zinkler, Schenk & Partner mbB, Radlkoferstraße 2, 81373 Müchen (DE).

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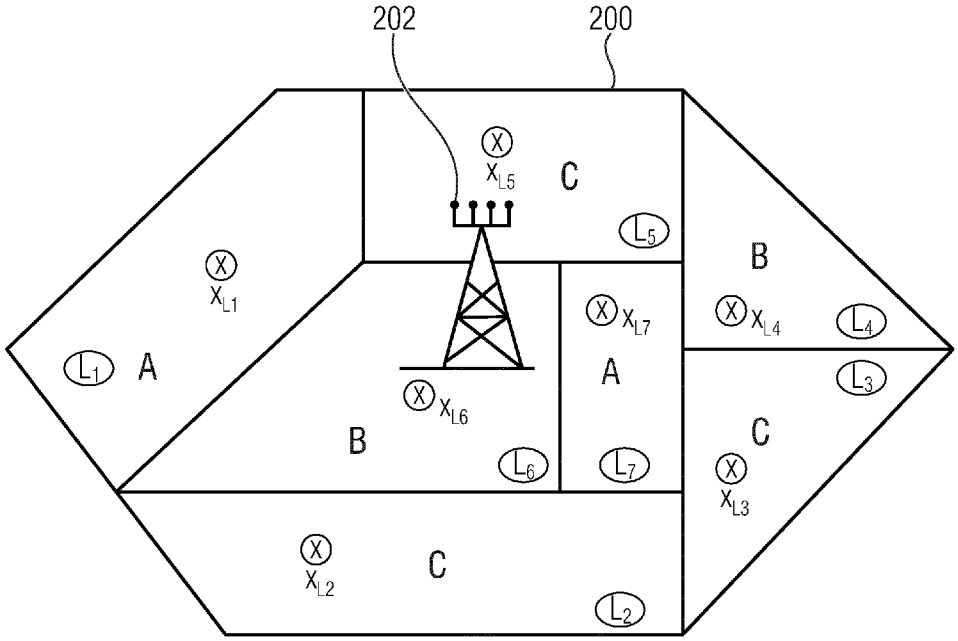

Fig. 2

(57) Abstract: A receiver receives a radio signal broadcast by a transmitter of a wireless communication network. The transmitter serves a cell of the wireless communication network in which the receiver is located. The radio signal has a plurality of configuration messages. Each configuration message includes information defining at least one location in the cell and parameters for a communication of the receiver with the wireless communication network. The parameters is associated with the certain location. The receiver determines the parameters for the communication of the receiver with the wireless communication network using a position of the receiver in the cell and the plurality of configuration messages.

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RECEIVER, TRANSMITTER, RADIO SIGNAL, WIRELESS COMMUNICATION NETWORK AND METHOD TO PROVIDE PARAMETERS FOR A COMMUNICATION OF THE RECEIVER WITH THE WIRELESS

Description

The present invention concerns the field of wireless communication networks or systems, and more specifically the transmission of control information from a base station to one or more receivers located within a cell of the wireless communication network, which is served by the transmitter. Examples describe a geographic radio resource management configuration signaling.

Fig. 1 is a schematic representation of an example of a network infrastructure, such as a wireless communication network or wireless communication system, including a plurality of base stations eNB_1 to eNB_5, each serving a specific area surrounding the base station schematically represented by the respective cells 100_1 to 100_5. The base stations are provided to serve users within a cell. A user may be a stationary device or a mobile device. Further, the wireless communication system may be accessed by IoT devices which connect to a base station or to a user. IoT devices may include physical devices, vehicles, buildings and other items having embedded therein electronics, software, sensors, actuators, or the like as well as network connectivity that enable these devices to collect and exchange data across an existing network infrastructure. Fig. 1 shows an exemplary view of only five cells, however, the wireless communication system may include more such cells. Fig. 1 shows two users UE1 and UE2, also referred to as user equipment (UE), that are in cell 100_2 and that are served by base station eNB_2. Another user UE_3 is shown in cell 100_4 which is served by base station eNB_4. The arrows 102_1, 102_2 and 102_3 schematically represent uplink/downlink connections for transmitting data from a user UE_1, UE_2 and UE_3 to the base stations eNB_2, eNB_4 or for transmitting data from the base stations eNB_2, eNB_4 to the users UE_1, UE_2, UE_3. Further, Fig. 1 shows two IoT devices 104_1 and 104_2 in cell 100_4, which may be stationary or mobile devices. The IoT device 104_1 accesses the wireless communication system via the base station eNB_4 to receive and transmit data as schematically represented by arrow 106_1. The IoT device 104_2 accesses the wireless communication system via the user UE_3 as is schematically represented by arrow 106_2.

The wireless communication system may be any single-tone or multicarrier system based on frequency-division multiplexing, like the orthogonal frequency-division multiplexing (OFDM) system, the orthogonal frequency-division multiple access (OFDMA) system defined by the LTE standard, or any other IFFT-based signal with or without CP, e.g. DFT-s-OFDM. Other waveforms, like non-orthogonal waveforms for multiple access, e.g. filter-bank multicarrier (FBMC), generalized frequency division multiplexing (GFDM) or universal filtered multi carrier (UFMC), may be used.

In a wireless communication network as it is, for example, depicted in Fig. 1, a plurality of mobile devices or UEs may be present within a cell. With an increasing number of mobile devices, control channels may become a bottleneck to serve mobile users. Due to the limited number of resources available to the control channels, providing a wireless connectivity in crowded areas of the cell, for example within a crowded train, may be difficult. There may not be enough resources available to coordinate the large number of UEs. In a cellular system, such as the one shown in Fig. 1, radio resource management (RRM) configuration settings may be transmitted to specific users directly, however, this leads to a high communication overhead because connectivity between each user and the base station is required. In accordance with other examples, the radio resource management configuration settings may be set to the same values for all users within a cell, either through configuration messages or through a standardized procedure. The radio resource management mechanism in 3GPP Release 10 are described in reference [1] (see chapter 22). The procedure that determines how to select the transmit power in random access messages may be the same and fixed for all users that attempt to register at the base station. For example, all users start from the same transmit power to register at the base station. If the registration is not successful, the transmit power is increased by a predefined value. This procedure is repeated until the registration is successful or until a maximum power value is reached. Thus, UEs experiencing a bad channels may require a long time to complete the registration procedure, in addition to wasting energy due to the failed messages.

It is an object of the present invention to provide an improved approach for signaling control information to one or more receivers located within a cell of a wireless communication network.

This object is achieved by the subject matter as defined in the independent claims.

Embodiments are defined in the dependent claims.

Embodiments of the present invention are now described in further detail with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic representation of an example of a wireless communication system;

Fig. 2 shows an example of a cell of a wireless communication network of Fig. 1 indicating schematically different coordinates/locations in the cell having associated therewith respective location dependent control parameters in accordance with embodiments of the inventive approach;

Fig. 3 is an example of a data signal in accordance with embodiments of the inventive approach, which is broadcast by the base station in Fig. 2, and which includes location information as well as information about an RRM parameter set;

Fig. 4 is a schematic representation of a wireless communication system for transmitting information from a transmitter to a receiver; and

Fig. 5 is a schematic representation of transmitters in a wireless communication system for transmitting control data to receivers in accordance with embodiments.

The present invention improves the distribution of control information to mobile users or UEs in a wireless communication network, in that a direct transmission of control information to individual UEs is avoided. The base station may broadcast configuration maps, also referred to as configuration messages, that contain information providing UEs with transmission parameters as a function of the geographic location of the UEs. In accordance with the examples, broadcasting the configuration messages may use a lossless transmission scheme or a lossy transmission scheme. The transmission parameters broadcast by the configuration messages may take into consideration the radio condition in specific areas of a cell served by the base station so that for the respective areas or locations within a cell the parameters may reduce the time to access the network and

save energy. For example by providing a suitable initial transmit power to be used by a UE, the time to complete the registration procedure and the waste of energy may be reduced. In accordance with examples, individual control messages are avoided and uplink connectivity from the receiver to the base station is not required. An arbitrary number of UEs may configure their transmission parameters based on the geographic location of the UE and information received from the base station. In other words, the inventive approach provides a geographic or location aware RRM configuration scheme that is designed for particular locations, areas or regions of the cell, rather than for particular users. Such a scheme is not implemented in conventional approaches.

The inventive approach is advantageous as, from the perspective of a base station, the radio resource management settings may be sent to an arbitrary number of devices without the need to establish a connection. For the UEs, impractical configurations may be avoided, thereby improving the overall quality of service, for example the time and energy spent to register to a base station may be decreased. In accordance with examples, the inventive approach may be provided for a location aware assignment of transmit power values in an uplink to support a connection establishment and re-establishment mechanism. Potential applications of location aware communication on PHY, MAC and network layers are described in reference [2].

Fig. 2 shows an example of a cell of a wireless communication network, as it is, for example, depicted in Fig. 1. The cell 200 is served by a base station 202, and within the cell 200 one or more UEs may be located. In Fig. 2, the UEs to be served by the base station 202 are not shown. On the basis of information about the radio conditions within respective areas or regions of the cell 200, which may be provided on the basis of radio maps generated for the cell 200, respective areas L_1 to L_7 of the cell 200 are identified in which the same or substantially the same radio conditions exist. In the example of Fig. 2, it is assumed that the regions L_1 and L_7 have substantially the same radio conditions so that the same RRM parameter set A may be determined to be used for these regions. In a similar way, the regions L_4, L_6 have assigned therewith the RRM parameter set B, and regions L_2, L_3, L_5 have assigned thereto the RRM parameter set C. The base station 202 generates a broadcast signal that may be sent over a broadcast channel of the wireless communication network, for example when considering the LTE standard, the signal may be sent over the PBCH (physical broadcast channel). The signal includes one or more control messages that may be received by any of the UEs located within the cell 200. While the base station 202 serves the cell 200, i.e. provides the possibility for establishing

a wireless connection between the UEs and the base station 202, in accordance with the inventive approach, for providing the control information to the respective UEs know connectivity between a UE and the base station 202 is not required, rather, the control information, by means of the control message, is broadcast by the base station 202 and may be received by the respective UEs.

Fig. 3 is an example of a data signal broadcast by the base station 202 in Fig. 2, and the data signal 300 includes location information 302 as well as information about an RRM parameter set 304. The location information indicates those areas/regions of the cell 200 having assigned thereto a specific RRM parameter set. Responsive to broadcasting the data signal 300 by the base station 202, a UE within the cell 200 may determine its location within the cell 200 and, dependent on its location, select from the data signal 300 the associated RRM parameter set 304 to be used for controlling a communication of the UE with the base station 202. For example, a UE located in location L_1 may determine its location and then select the RRM parameter set A as most suitable parameter set for the communication in view of the specific radio condition in this area of the cell 200.

Thus, in accordance with examples of the inventive approach described herein, the base station 202 broadcasts one or more tuples of geographic coordinates and RRM configuration parameter values to all potential users in the cell 200. Mathematically, the i-th RRM configuration message at time t may be expressed as tuples $(x_{i,t}, c_{i,t})$, where $x_{i,t}$ is a coordinate vector that describes a particular geographic position or region which may be referred to as a configuration location, and $c_{i,t}$ is a vector of RRM configuration settings for the coordinate $x_{i,t}$. The tuples may be broadcast, for example, using dedicated channels for control information that are available in accordance with a cellular communication standard, like the LTE PPCH. An advantage of the inventive approach is that the amount of data transmitted may be adapted to the available resources for the respective control channels. The tuples control messages, in accordance with examples, are not necessarily sent closely spaced in time, and the granularity of the grid of coordinates is also not fixed. For example, in delay tolerant applications, a UE may wait until settings corresponding to a nearby location are received. If delay is an issue, the UE may use a setting from the closest received location. In accordance with other examples, the UE may extrapolate control parameters based on control messages already received and decoded, for example by using a machine learning tool.

The geometric information about the system state around the base station is provided, for example, by radio maps. Radio maps may be generated using machine learning techniques using readily available RRM measurements and user location information, as it is described, for example in reference [3]. The UEs require knowledge of their own position. In accordance with examples, the UEs may be equipped with a GPS receiver and/or the location of a UE may be determined using a mobile radio cellular positioning protocol, like the location position in protocol LPP.

With reference to Figs. 2 and 3 one example of the inventive approach has been described, however, the invention is not limited to this example. In accordance with other examples, rather than providing location information describing the entire area, like area L_1, only specific points in the cell 200, like location x_{L1} (see Fig. 2) may be provided. UEs within the cell 200 may determine on the basis of their location and on the basis of a distance to the coordinate X_{L1} whether the parameter set A is to be used or not. In accordance with further examples, rather than sending the parameter settings for the entire cell 200, i.e. for each of the areas/regions L_1 to L_7 or for each of the respective coordinates x_{L1} to x_{L7}, the control messages for the different regions may be sent at different times. For example at a first time only one configuration message for one or more areas of the cell 200 is sent, and at a subsequent time instant another control message for one or more other areas is sent. For example, at a first time, t_i only the parameter set A may be transmitted together with the location information for areas/coordinates L_1 and L_7, and at a later time t_{i+1} the information for the other areas or at least some of the other areas may be transmitted. In such a scenario, UEs running delay tolerant applications and determining that a currently transmitted control message is for a coordinate in a distance beyond a threshold, may wait until a configuration message is received for a location or area having a distance to the location opposition of the UE which is below the threshold. On the other hand, in case an application run on a UE does not allow for a delay or is delay-sensitive, the UE, despite the fact that the currently sent configuration message is for a region/area in which the UE is not located, i.e. the distance to the signaled coordinate is, for example, greater than a predefined threshold, the UE may decide to use the parameters indicated in this configuration message for the radio resource management. Alternatively, as mentioned above, in case the UE already received a number of control messages for areas around its location, it may use the respective parameters and extrapolate, on the basis of these received and decoded parameters its own radio resource management parameters to be used for communication in the communication network.

In accordance with further examples, the UE may take into consideration local information when deciding about the RRM parameter set to be used. Such local information may not be available at the base station and may include information about the environment in which the UE is currently located or about the position at which the UE will be located once a communication with the network is started.

For example, the UE may have knowledge about its environment, e.g. the topology around the UE. Based on this knowledge, the UE may determine that a radio connection from the UE's position to the closest location indicated in the control message is likely to have a reduced or bad quality such as a bad channel condition, e.g., because there is no line of sight connection possible to the closest location due to obstacles, like buildings. In such a case, the UE may select the RRM parameter set associated with a more remote location to which, however, a line of sight connection exists.

In accordance with another example, the UE may be a mobile UE that is currently moving in the cell. The UE may determine a direction and speed of the movement so that it has knowledge about an estimated position at which the UE will be once the actual communication starts, i.e., at what position the UE will be once the connection set up has been completed. On the basis of this knowledge the UE may select from the control message the RRM parameter set associated with a location closest to the estimated position, rather than the RRM parameter set associated with a location closest to the current position of the UE.

In the examples of Figs. 2 and 3, the respective regions/areas having associated therewith the different RRM parameters A to C are shown as being separated from each other, however, this is only a schematic representation, and in accordance with examples, the L1 to L7 may have an overlap, and the UE within the cell 200 may determine on the basis of its own position and a distance to the coordinates indicated in the control message which of the RRM parameters from the signaled set, associated with the respective areas, is to be used.

Thus, in accordance with the examples of the present invention, at certain points in time, the base station 200 broadcasts the geographic control information that is received by all users in the cell 200, for example by broadcasting the control information using the PBCH or any other existing channel for control information. The broadcast control information may comprise a variable number of configuration messages, and each configuration mes-

sage 300 includes a combination of a coordinate vector 302 identifying a certain geographic region or location within the cell 200, and a vector 304 of radio resource management parameters associated with this specific coordinate/area. The configuration messages may be sent at varying time intervals and with varying distance between the respective coordinates, dependent on the resources available within the cell 200 to perform the signaling of the control information. In other words, in the example of Figs. 2 and 3, varying distances between the coordinates may mean that in case the available resources for control information transmission is reduced, also the number of coordinates is reduced so that the number of areas in the cell 200 having associated therewith different RRM parameters is also reduced. On the other hand, in case more resources are available for signaling, more areas may be defined, i.e. the granularity may be increased.

The control locations and the distances from each other may be chosen by the base station based on the radio maps that map geographic coordinates to information about the system state, for example, the radio propagation conditions. Based on the radio maps, the base station may identify regions of similar conditions, like regions L_1, L_7, areas L_4, L_6 and areas L_2, L_3 and L_5 so that for such identified regions, the transmit configuration information may be the same.

Based on its position, the UE may choose which particular configuration to apply, for example the configuration vector within the configuration message that is closest to its position. UEs that do not have knowledge about their position may ignore the geographic RRM configuration information and apply the procedures currently used in accordance with mobile communication standards for gathering the RRM parameter information.

Embodiments of the present invention may be implemented in a wireless communication system as depicted in Fig. 1 including base stations, users, like mobile terminals or IoT devices. Fig. 4 is a schematic representation of a wireless communication system 400 for communicating information between a transmitter TX and a receiver RX. The transmitter TX includes one or more antennas ANT_{TX} or an antenna array having a plurality of antenna elements. The receiver RX includes one or more antennas ANT_{RX}. As is indicated by the arrow 402 signals are communicated between the transmitter TX and the receiver RX via a wireless communication link, like a radio link. The wireless communication system may operate in accordance with the techniques described herein.

For example, the receiver RX receives via the one or more antennas ANT_{RX} a radio signal broadcast by the transmitter TX. The transmitter TX serves a cell of the wireless communication network in which the receiver RX is located. The radio signal has a plurality of configuration messages, and each configuration message includes information defining at least one location in the cell and parameters for a communication of the receiver with the wireless communication network, the parameters being associated with the certain location. The receiver RX includes a signal processor 404 to determine the parameters for the communication of the receiver RX with the wireless communication network using a position of the receiver RX in the cell and the plurality of configuration messages. The transmitter TX comprises a signal processor 406 to generate the radio signal which has the plurality of configuration messages. Each of the configuration messages includes the information defining the at least one location in the cell and the parameters for the communication of the receiver RX with the wireless communication network. The parameters are associated with the certain location. The transmitter TX serves the receiver RX in the cell of the wireless communication network and broadcasts the radio signal to the receiver RX.

Fig. 5 is a block diagram of a transmitter 400 in a wireless communication system for transmitting information to a receiver in accordance with embodiments described above. The transmitter 400 receives data 402 that is encoded by the channel encoder 404, modulated by the modulator 406 and mapped to multiple carriers by the mapper 408. The signal 410 is combined at 412 with control signals 414 provided by the control channel unit 416 and the control mapper 418, with pilot symbols 420 from the pilot symbol generator 422, and with PSS/SSS signals 424 from the PSS/SSS signal generator 326. The combined signal 428 is provided to the IFFT+CP block 430, is converted by the DAC 432 into the analog domain. The analog signal 436 is processed for radio transmission and eventually transmitted by the antenna 438. In accordance with embodiments, the inventive aspects may be implemented using the control channel unit 416 and the control mapper 418 to generate the plurality of configuration messages to be broadcast using the radio signal. The control channel unit 416 and the control mapper 418 generate the configuration messages so that they include the information defining the at least one location in the cell and the location dependent parameters for the communication of a receiver with the wireless communication network.

Although some aspects of the described concept have been described in the context of an apparatus, it is clear that these aspects also represent a description of the corresponding method, where a block or a device corresponds to a method step or a feature of a method

step. Analogously, aspects described in the context of a method step also represent a description of a corresponding block or item or feature of a corresponding apparatus.

Depending on certain implementation requirements, embodiments of the invention may be implemented in hardware or in software. The implementation may be performed using a digital storage medium, for example cloud storage, a floppy disk, a DVD, a Blue-Ray, a CD, a ROM, a PROM, an EPROM, an EEPROM or a FLASH memory, having electronically readable control signals stored thereon, which cooperate (or are capable of cooperating) with a programmable computer system such that the respective method is performed. Therefore, the digital storage medium may be computer readable.

Some embodiments according to the invention comprise a data carrier having electronically readable control signals, which are capable of cooperating with a programmable computer system, such that one of the methods described herein is performed.

Generally, embodiments of the present invention may be implemented as a computer program product with a program code, the program code being operative for performing one of the methods when the computer program product runs on a computer. The program code may for example be stored on a machine readable carrier.

Other embodiments comprise the computer program for performing one of the methods described herein, stored on a machine readable carrier. In other words, an embodiment of the inventive method is, therefore, a computer program having a program code for performing one of the methods described herein, when the computer program runs on a computer.

A further embodiment of the inventive methods is, therefore, a data carrier (or a digital storage medium, or a computer-readable medium) comprising, recorded thereon, the computer program for performing one of the methods described herein. A further embodiment of the inventive method is, therefore, a data stream or a sequence of signals representing the computer program for performing one of the methods described herein. The data stream or the sequence of signals may for example be configured to be transferred via a data communication connection, for example via the Internet. A further embodiment comprises a processing means, for example a computer, or a programmable logic device, configured to or adapted to perform one of the methods described herein. A further em-

bodiment comprises a computer having installed thereon the computer program for performing one of the methods described herein.

In some embodiments, a programmable logic device (for example a field programmable gate array) may be used to perform some or all of the functionalities of the methods described herein. In some embodiments, a field programmable gate array may cooperate with a microprocessor in order to perform one of the methods described herein. Generally, the methods are preferably performed by any hardware apparatus.

The above described embodiments are merely illustrative for the principles of the present invention. It is understood that modifications and variations of the arrangements and the details described herein will be apparent to others skilled in the art. It is the intent, therefore, to be limited only by the scope of the impending patent claims and not by the specific details presented by way of description and explanation of the embodiments herein.

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CLAIMS

1. A receiver, wherein

the receiver is configured to receive a radio signal broadcast by a transmitter of a wireless communication network, the transmitter serving a cell of the wireless communication network in which the receiver is located,

the radio signal comprises a plurality of configuration messages, each configuration message including information defining at least one location in the cell and parameters for a communication of the receiver with the wireless communication network, the parameters being associated with the certain location, and

the receiver is configured to determine the parameters for the communication of the receiver with the wireless communication network using a position of the receiver in the cell and the plurality of configuration messages.

2. The receiver of claim 1, configured to set the radio communication parameters for a communication with wireless communication network according to the parameters determined.

3. The receiver of one of the preceding claims, configured to determine the position of the receiver relative to the location indicated in the configuration message, and to determine the parameters from the configuration message, when a distance of the receiver to the location indicated in the configuration message is equal to or less than a predefined threshold.

4. The receiver of claim 3, configured to determine the parameters from the closest configuration message, when the distance of the receiver to the location indicated in the configuration message is greater than a predefined threshold and when the receiver requires to quickly setup a connection with the wireless communication network.

5. The receiver of claim 1 or 2, configured to determine the parameters by extrapolating parameters from a plurality of configuration messages received and decoded by the receiver.

6. The receiver of one of the preceding claims, configured to determine the parameters further on the basis local information.

7. The receiver of claim 6, wherein the local information comprises information about the environment in which the receiver is currently located or information about a position at which the receiver will be located once a communication with the network is started.

8. The receiver of one of the preceding claims, comprising a satellite receiver configured to determine the position of the receiver using a satellite based positioning system such as GPS, the GLONASS, Galileo or Beidou.

9. The receiver of one of the preceding claims, configured to determine the position of the receiver using a mobile radio cellular positioning protocol, such as the location positioning protocol (LPP).

10. The receiver of one of the preceding claims, wherein the plurality of configuration messages are received at the same time or at different times.

11. The receiver of one of the preceding claims, wherein the location in the cell indicates one or more geographical locations or geographical areas in the cell.

12. The receiver of one of the preceding claims, wherein a plurality of the locations in the cell have associated therewith the same parameters for the communication with the wireless communication network.

13. The receiver of one of the preceding claims, wherein the parameters for the communication with the wireless communication network comprise parameters to control radio transmission characteristics, such as transmit power, user allocation, beamforming, data rates, handover criteria, modulation scheme, error coding scheme, etc.

14. The receiver of claim 13, wherein the parameters comprise radio resource management (RRM) control parameters.

15. A transmitter, wherein

the transmitter is configured to broadcast a radio signal to one or more receivers in a cell of a wireless communication network, the transmitter serving the cell of the wireless communication network in which the receivers are located, and

the radio signal comprises a plurality of configuration messages, each configuration message including information defining at least one location in the cell and parameters for a communication of a receiver with the wireless communication network, the parameters being associated with the certain location.

16. The transmitter of claim 15, configured to broadcast one or more configuration messages at same time, or to broadcast one or more configuration messages at different times.

17. The transmitter of claim 15 or 16, configured to determine resources in the wireless communication network which are available for control signaling, and to determine time intervals for broadcasting the configuration messages and a distance between the locations dependent on the available resources for control signaling.

18. The transmitter of one of claims 15 to 17, configured to select the locations and the distances of the locations from each other based on radio maps, the radio maps mapping geographical coordinates to information about the system state, such as radio propagation conditions or radio conditions.

19. The transmitter of claim 18, wherein locations having similar radio conditions have associated therewith the same parameters.

20. The transmitter of one of claims 15 to 19, configured to broadcast the radio signal over a broadcast channel of the wireless communication network.

21. A radio signal, comprising

a plurality of configuration messages,

wherein each configuration message includes information defining at least one location in a cell of a wireless communication network and parameters for a communication of a receiver with the wireless communication network, the parameters being associated with the certain location, and

wherein the radio signal is to be broadcast by a transmitter of the wireless communication network to one or more receivers in the cell, the cell being served by the transmitter.

22. A wireless communication network, comprising:

a receiver of one of claims 1 to 14; and

a transmitter of one of claims 15 to 20.

23. The wireless communication network of claim 22, wherein the wireless communication network comprises a cellular network, a wireless local area network or a wireless sensor system.

24. The wireless communication network of claim 23, wherein the receiver is a mobile terminal and the transmitter is a base station of a cellular network.

25. The wireless communication network of claim 24, wherein the cellular network uses an IFFT (Inverse Fast Fourier Transform) based signal.

26. The wireless communication network of claim 25, wherein the IFFT based signal includes OFDM with CP, DFT-s-OFDM with CP, IFFT-based waveforms without CP, f-OFDM, FBMC, GFDM or UFMC.

27. A method, comprising:

receiving, by a receiver of a wireless communication network, a radio signal broadcast by a transmitter of the wireless communication network, the transmitter serving a cell of the wireless communication network in which the receiver is located, where-

in the radio signal comprises a plurality of configuration messages, each configuration message including information defining at least one location in the cell and parameters for a communication of the receiver with the wireless communication network, the parameters being associated with the certain location, and

determining, by the receiver, the parameters for the communication of the receiver with the wireless communication network using a position of the receiver in the cell and the plurality of configuration messages.

28. A method, comprising:

broadcasting, by a transmitter of a wireless communication network, a radio signal to one or more receivers in a cell of the wireless communication network, the transmitter serving the cell of the wireless communication network in which the receivers are located,

wherein the radio signal comprises a plurality of configuration messages, each configuration message including information defining at least one location in the cell and parameters for a communication of a receiver with the wireless communication network, the parameters being associated with the certain location.

29. A method, comprising:

broadcasting, by a transmitter of a wireless communication network, a radio signal to one or more receivers in a cell of the wireless communication network, the transmitter serving the cell of the wireless communication network in which the receivers are located, wherein the radio signal comprises a plurality of configuration messages, each configuration message including information defining at least one location in the cell and parameters for a communication of a receiver with the wireless communication network, the parameters being associated with the certain location;

receiving, by a receiver of the wireless communication network, the radio signal broadcast by the transmitter; and

determining, by the receiver, the parameters for the communication of the receiver with the wireless communication network using a position of the receiver in the cell and the plurality of configuration messages.

30. A non-transitory computer program product comprising a computer readable medium storing instructions which, when executed on a computer, perform the method of one of claim 27 to 29.

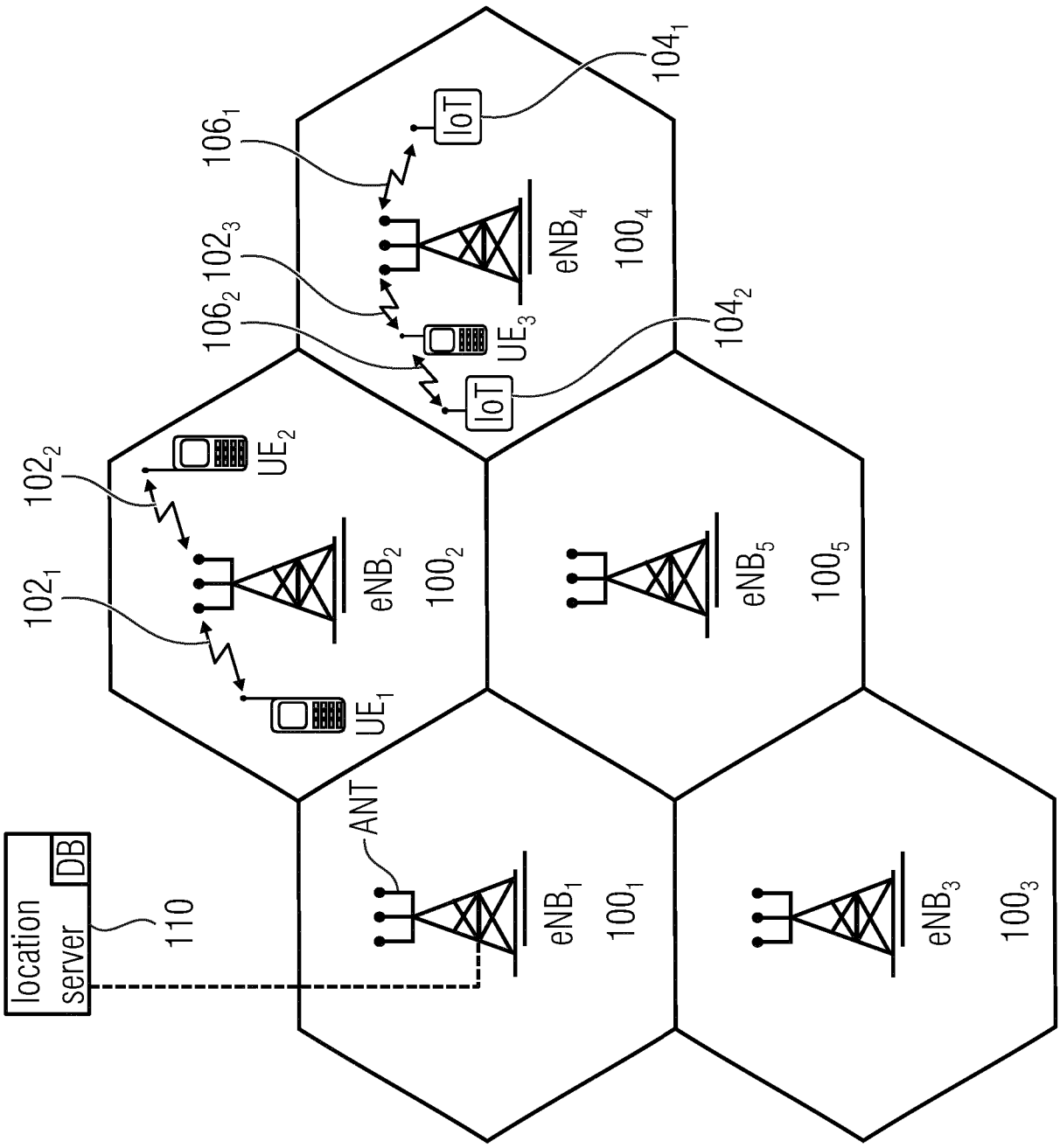
location server
DB
110
ANT
eNB1
1001
eNB2
1002
eNB3
1003
eNB4
1004
eNB5
1005
UE1
UE2
UE3
IoT
IoT
1021
1022
1023
1041
1042
1061
1062

Fig. 1

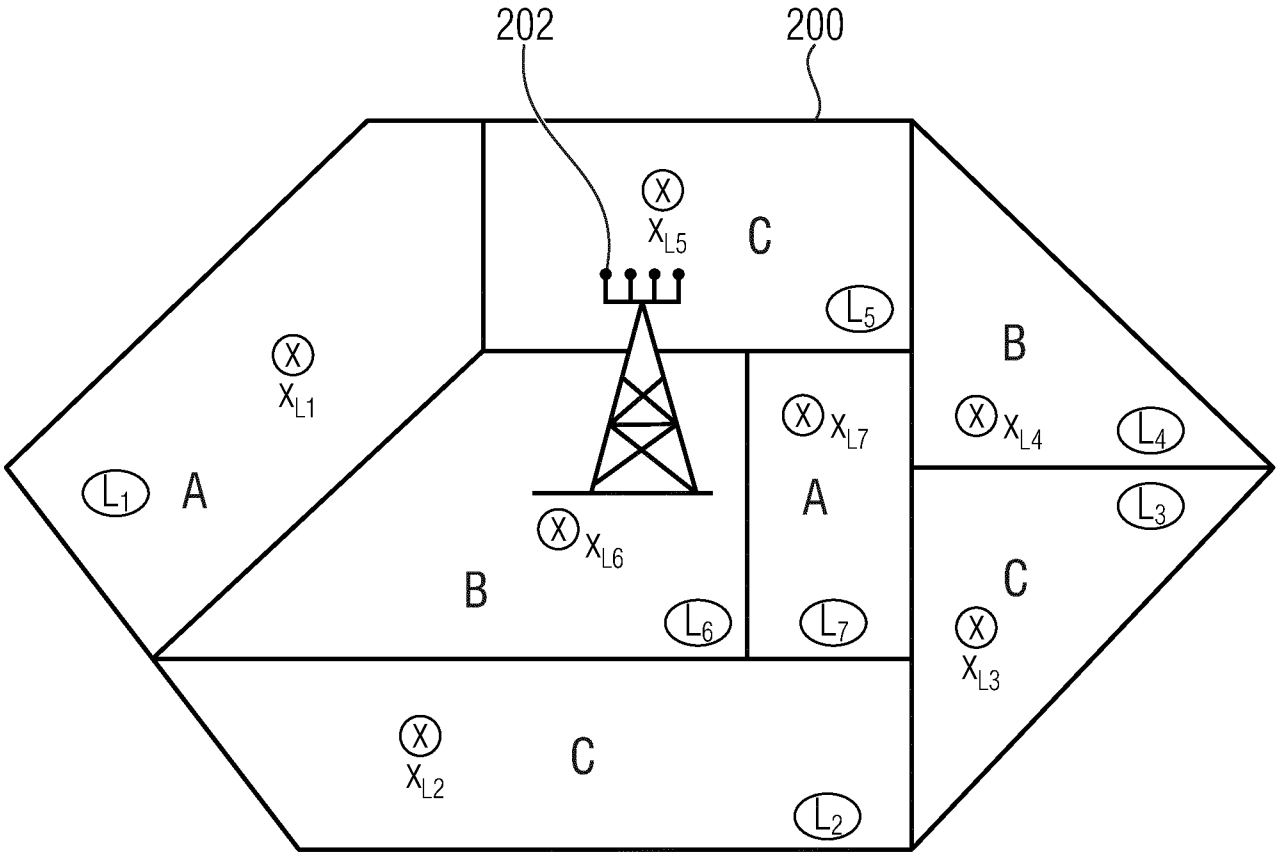
202
200
X
X_{L5}
C
L_5
B
X_{L1}
X_{L7}
X_{L4}
L_4
L_1
A
A
L_3
X_{L6}
C
B
L_6
L_7
X_{L3}
X_{L2}
C
L_2

Fig. 2

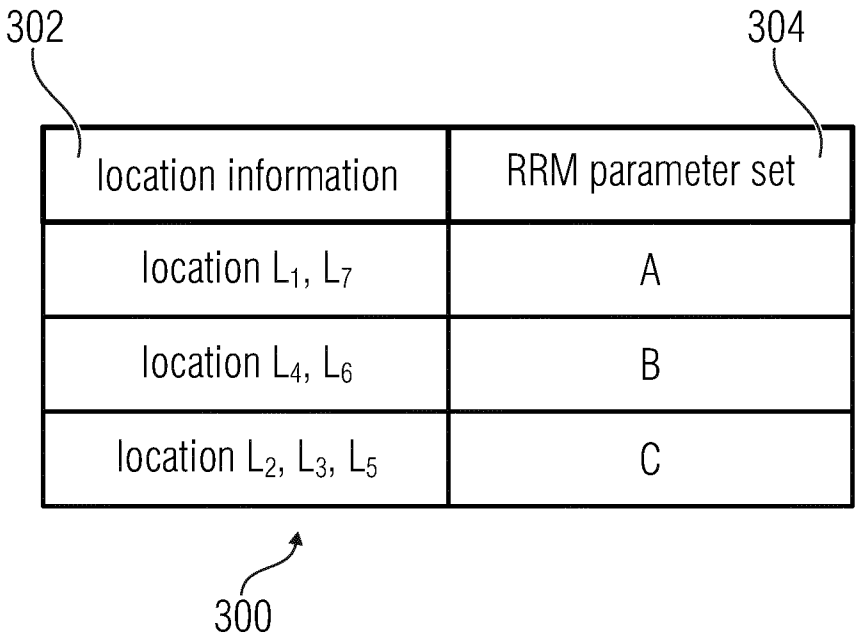
302
304
location information
RRM parameter set
location L_1, L_7
A
location L_4, L_6
B
location L_2, L_3, L_5
C
300

Fig. 3

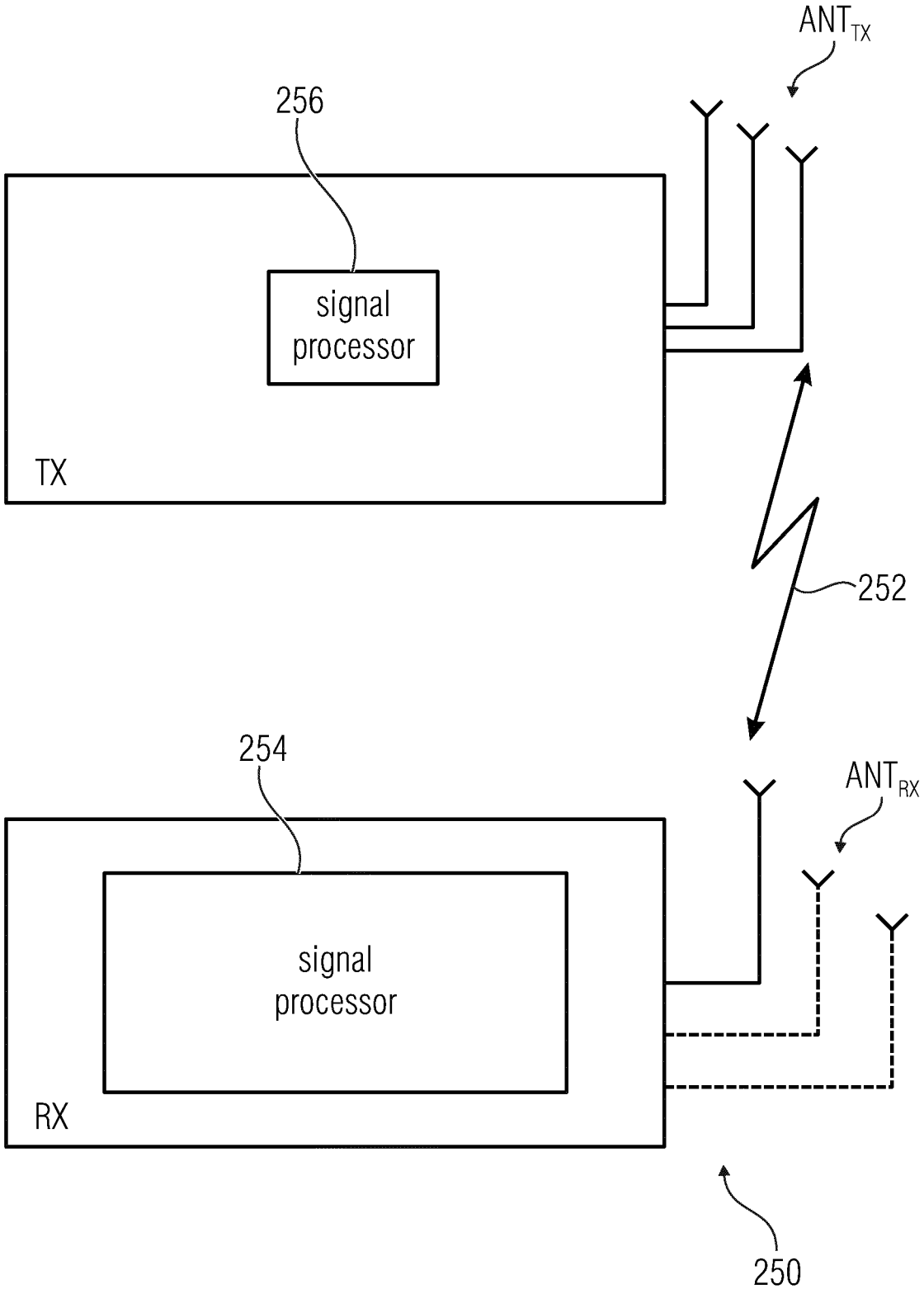
ANT$_{TX}$
256
signal processor
TX
252
254
ANT$_{RX}$
signal processor
RX
250

Fig. 4

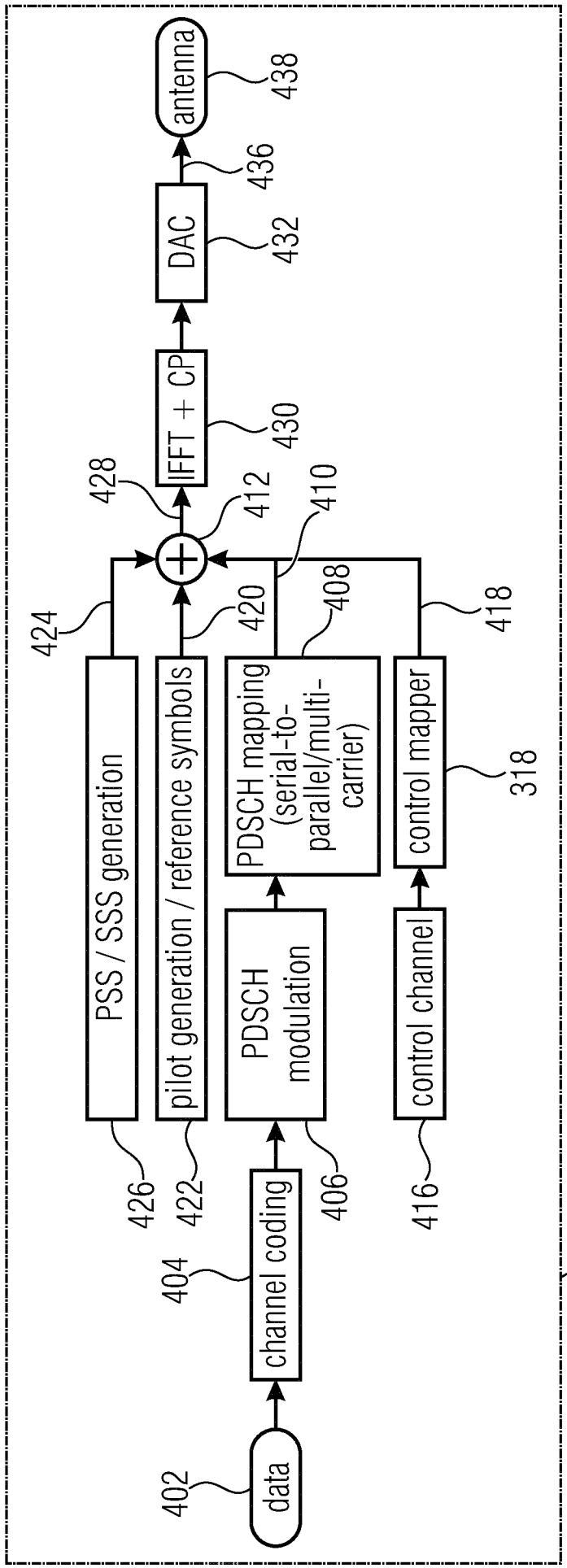
antenna
438
436
DAC
432
IFFT + CP
430
428
412
410
424
420
408
418
PSS / SSS generation
pilot generation / reference symbols
PDSCH mapping (serial-to-parallel/multi-carrier)
control mapper
318
PDSCH modulation
control channel
426
422
406
416
404
channel coding
400
402
data

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/075363

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W4/02 H04W60/00 H04W8/24
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2002/072369 A1 (SASADA KOJI [JP] ET AL) 13 June 2002 (2002-06-13) paragraphs [0010], [0013], [0018], [0022], [0091] -----	1-17, 20-30 18,19
Y	KDDI ET AL: "L1/L2 Control Channel Structure with CDM Based Multiplexing in E-UTRA Downlink", 3GPP DRAFT; R1-063349, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Riga, Latvia; 20061102, 2 November 2006 (2006-11-02), XP050103792, [retrieved on 2006-11-02] page 3; figure 2 -----	18,19
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 March 2017	27/03/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Adhari, Hakim

1

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	James Donovan: "Cells, Sectors and Antenna Beamforming ¦ CommScope", , 28 May 2014 (2014-05-28), XP055355812, Retrieved from the Internet: URL:http://www.commscope.com/Blog/Cells--Sectors-and-Antenna-Beamforming/ [retrieved on 2017-03-16] the whole document	1-30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/075363

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